

Fiber Optic Temperature Sensors for Thermal Protection Systems, Phase II

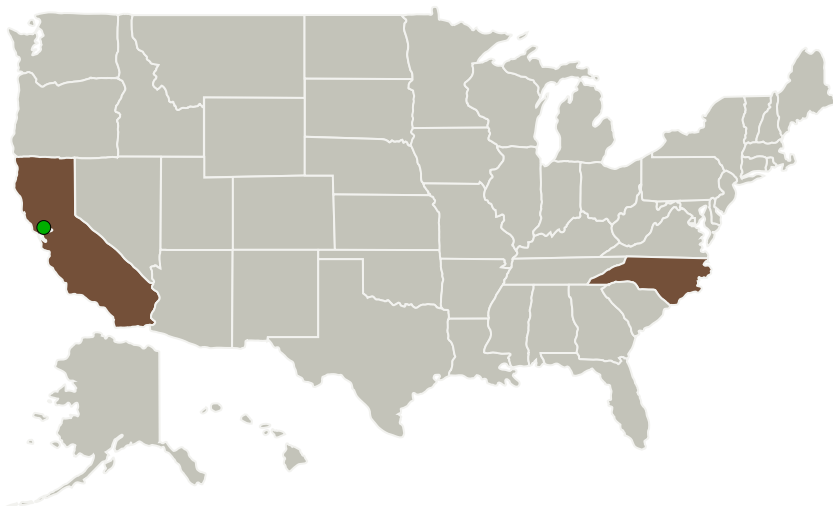
Completed Technology Project (2012 - 2014)



Project Introduction

In Phase 1, Intelligent Fiber Optic Systems Corporation (IFOS), in collaboration with North Carolina State University, successfully demonstrated a Fiber Bragg Grating (FBG)-based system for simultaneous, continuous, multipoint temperature measurements at different depths in a representative Thermal Protection System (TPS) material (Super Lightweight Ablator – SLA), with testing performed near its char temperature. Special high-temperature FBG sensors were also developed and tested to 1000°C with an applied 7 kpsi tensile stress, and with an applied 18 kpsi after cooling to room temperature. A pure thermal loading calibration of these sensors in this temperature range was performed. The response of the FBG sensors was much faster than that of thermocouples, and all electrical wires were replaced with a single optical fiber. In Phase 2, IFOS will embed 1000 °C-capable optical fiber sensors into a TPS material. Following an appropriate instrumentation development, we will demonstrate temperature profile measurements with a depth resolution of 250-µm or better. We will also distinguish between temperature- and strain-induced responses in the FBG sensors, a critical consideration for embedded sensor arrays. Our Phase 2 base work plan is designed to advance the TRL to 5, with TRL 6 being obtained in a Phase 2-E program.

Primary U.S. Work Locations and Key Partners



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Organizations Performing Work	Role	Type	Location
Intelligent Fiber Optic Systems Corporation	Lead Organization	Industry	Santa Clara, California
● Ames Research Center(ARC)	Supporting Organization	NASA Center	Moffett Field, California
North Carolina State University at Raleigh	Supporting Organization	Academia	Raleigh, North Carolina

Primary U.S. Work Locations

California	North Carolina
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Project Transitions

▶ **August 2012:** Project Start

✓ **August 2014:** Closed out

Closeout Documentation:

- Final Summary Chart(<https://techport.nasa.gov/file/138085>)

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Intelligent Fiber Optic Systems Corporation

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Principal Investigator:

Richard J Black

Co-Investigator:

Richard W Black

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Technology Maturity (TRL)

Start: **3**
Current: **5**
Estimated End: **5**



Technology Areas

Primary:

- TX14 Thermal Management Systems
 - └ TX14.3 Thermal Protection Components and Systems
 - └ TX14.3.5 Thermal Protection System Instrumentation

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System